Available online at www.sciencedirect.com
ScienceDirect
ELSEVIER
Desalination 209 (2007) 108–112
DESALINATION
www.elsevier.com/locate/desal

Effect of non-technical factors on the electricity cost of the photovoltaic (PV) systems

Ahmad Zahedi*, Joe Hallenstain

Solar Energy Applications Research Group,
Department of Electrical and Computer Systems Engineering, Monash University,
Wellington Road, Clayton, Vic. 3168, Australia
Fax +61 3 9905-3454; email: zahedi@eng.monash.edu.au

Abstract

There is an extensive range of applications where the photovoltaic (PV) systems are already viewed as the best and economical option for electricity supply. These systems are usually stand-alone, and exploit the following advantages of PV electricity: (i) there are no fuel costs or fuel supply problems; (ii) the equipment can usually operate unattended; (iii) it is very reliable and requires little maintenance. These advantages make solar PV to be seen as the greatest opportunity of electricity generation for billions of people throughout the world without electricity. However, there are some barriers hindering growth of this sector as the high cost of photovoltaic systems is capital intensive. The objective of this contribution to the conference is to present the results of a study conducted on the effects of non-technical factors on the capital and electricity costs of PV systems. In our research group we have developed a numerical method for calculating the electricity cost (considering time value of money) of the solar photovoltaic energy systems, which includes grid-connected, stand-alone and hybrid system. One of the features of this method is that it allows program user to investigate the effects of non-technical factors on the electricity cost of renewable sources.

1. Introduction

There are many applications where the PV systems are the most economical option for electricity supply. However, there are some technical and non-technical barriers hindering development of solar photovoltaic systems.

Areas in which non-technical barriers exist are

- Lack of awareness
- By the community
- New technology
- Seen as untested and risky
- Leading to high cost

*Corresponding author.

The Ninth Arab International Conference on Solar Energy (AICSE-9), Kingdom of Bahrain

0011-9164/06/$– See front matter
doi:10.1016/j.desal.2007.04.017

The main applications of solar photovoltaic energy systems for the purpose of electricity generation are

- Grid-connected
- Stand-alone, and
- PV Hybrid system.

The latter combines PV array with a conventional electricity generating unit such as diesel generator. Solar photovoltaic energy systems have many advantages. They are modular and silent, they have no moving parts, they require low maintenance, and produce no emissions. However, they have a relatively high capital and electricity cost. Fig. 1 shows the range of cost of PV electricity in comparison with the other types of renewable energy and technologies.

Australia like much other overseas country has developed a Photovoltaic Rebate Program for PV systems installed on residential and community buildings. This financial support makes installation of grid-connected PV systems more affordable and consequently reduces the PV electricity price to a competitive level.

Although fuel of solar PV generators is free, but price of PV electricity is far above the price of electricity from conventional fossil fuel power plants. And also PV electricity is the most expensive amongst the other renewable electricity prices. This has been clearly shown in Fig. 1.

This high capital cost is affected by some technical factors such as efficiency, technology, reliability, location, orientation, tilt, as well as some non-technical factors, which are often overlooked.

Non-technical factors are classified as

- Awareness, attitudes and acceptance of customers and energy providers
- Financing
- Research and development
- Demonstration and marketing
- Regulatory measures
- Market-based factors
- Electricity infrastructure factors

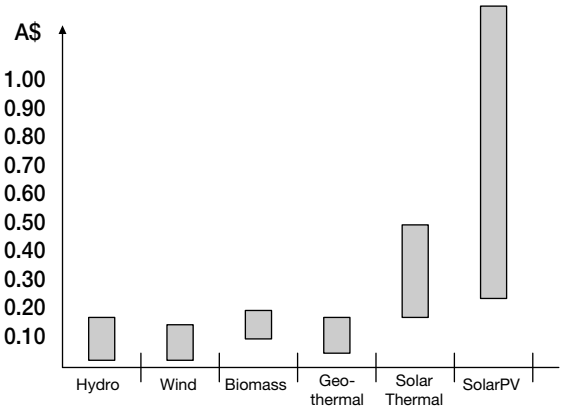

Fig. 1. Comparative electricity costs of renewable energies.

With regards to the financing, installation of solar PV systems require a large amount of upfront capital and it is more difficult to attract finance and to compete with electricity from conventional power plants.

In this approach we tried to minimize the cost of hybrid power system by optimizing the size of PV system and investigate the effect of some non-technical factors on these costs. In order to make sure that this does not result in poor performance of the system we have tried to predict the performance of the system.

In our research group we have developed a program, which has many features including size optimization, cost calculation and performance prediction of any type of solar PV system. This program also enables us to see the effect of non-technical factors such as interest rate, discount rate, mortgage rate, etc. on the capital and electricity cost of the solar PV system under investigation.

We would like to present the results obtained from this program for a hybrid power system, which has been designed with optimum size to supply electricity for a remote located facilities, which requires an average of 18 kW h of electricity per day.

Configuration of the system under investigation has been shown in Fig. 2. The system consists of